subjected in each case; and it is therefore less than the former figure by the smelting losses of various kinds. The latter form of return would be decidedly the more useful, but is the more difficult to obtain correctly. It is, however, essential that one or other of these two methods be adopted, and not sometimes the one and sometimes the other.

The report also deals with the number of persons employed in producing the mineral output of the various countries, and there is perhaps no portion of the statistical records before us in which more divergent methods of enumeration are made use of. Some countries return indiscriminately men, boys, women, and girls, and some Europeans and natives all under the same heading, whilst others separate these categories. In Germany the usual practice is to return the full number of all names on the register, ill or well, at work or idle, working whole shifts or only parts, working throughout the year or only for a portion, as the number actually employed. The present writer does not know with certainty what the practice is in Great Britain, and doubts whether there is any generally accepted practice; certainly there is none that has legislative sanction. Most managers in this country simply return the number of men on their books on the day when the return is made out; a few seem to consider that the number of shifts worked in the year divided by the the number of shifts worked in the year divided by the number of actual working days. A better method probably would be to take as the average number of men employed daily the total number of shifts worked in the year divided by the number of possible working days. A still more exact method has been proposed by some authorities, and is carried out in some places on the Continent, in connection with schemes of insurance, namely, to take the total number of hours worked in a year by the whole of the workpeople employed, and to divide this figure by some standard figure which shall represent the average number of working hours in a year; this average number might for the United Kingdom be taken as 2400, namely, 300 days of eight hours. Obviously here, again, an international agreement is indispensable. Furthermore, it is necessary to decide whether any, and if so, which of the mine officials shall be included in the list of mine workers; the general practice appears to be to include subordinate officials but none of the staff and none of the office employés, but here again much diversity of practice exists.

Further difficulties arise with reference to the classification of mine workings, our distinction between mines and quarries being quite different from that which obtains in other countries. There is no uniformity of practice in respect of the substances which ought properly to be included in a return of mineral output, and it is an open question whether, *e.g.* brick-clay should be included as well as fire-clay, salt derived from sea water as well as rock-salt, and so forth.

Enough has been said to show that the figures in the report before us must be used cautiously, and that it is unwise to attempt to draw deductions from them unless their meaning is quite fully understood in each case. No doubt this fact detracts considerably from the utility of such a report but it need hardly be said that not the slightest blame can be imputed to those responsible for the report for the existing state of affairs. The work of the statician should, however, always be more than the mere unintelligent accumulation of figures, and here there is ample scope for someone who could persuade the principal mining countries of the world to agree upon a common basis for drawing up the essential elements of mineral records.

At the recent International Congress of Mining and Metallurgy, the question of the unification of mineral statistics occupied a prominent position, and, in fact, the only resolution that was thought worthy of being brought before the general meeting, and was unanimously adopted, was to the effect that the congress should urge upon the various Governments there represented the importance of the adoption of an international system. The report just published by the Home Office is only another proof, if such were indeed needed, of the urgency of such a step, and it is greatly to be desired that our Home Office would take upon itself to lead the way in this matter. It has for many years past made a special feature of the collection of international mineral statistics, and it would be eminently appropriate that Great Britain should inaugurate an attempt to arrive at an international understanding; there can be no doubt that the other Great Powers interested in the question would heartily welcome such a step, and that an international commission could easily enough arrive at a satisfactory arrangement. Until this has been done, all the expense, care, and trouble involved in producing part iv. of the "Mines Report—Colonial and Foreign Statistics," must necessarily be to a large extent wasted, since it cannot but fail in giving a proper comparative view of the world's mineral industry.

Henry Louis.

NOTES.

The *Times* correspondent at Stockholm reports that the Nobel prizes, amounting to more than 8000*l.* each, were distributed by the King of Sweden on December 10 with the usual ceremonial. All the prize-winners were present to receive their prizes and give the statutory lecture, except the winner of the prize for literature, Herr Paul Heyse, who was prevented by his advanced age from attending. The other recipients were Profs. Van der Waals (physics), Wallach (chemistry), and Kossel (medicine).

The Physical Society's annual exhibition, which is to be held on Tuesday, December 20, will be open both in the afternoon (from 3 to 6 p.m.) and evening (from 7 to 10 p.m.). Prof. J. A. Fleming, F.R.S., will give a discourse at 4.15 p.m., and again at 8 p.m., on some improvements in transmitters and receivers for wireless telegraphy, and Mr. R. W. Paul will give a number of kinematograph demonstrations of some physical phenomena. Most of the leading makers of scientific instruments are sending apparatus to the exhibition.

The opening address by Dr. Muir, C.M.G., F.R.S., to the South African Association for the Advancement of Science was delivered before a large audience in Cape Town on the evening of October 31, the day of the arrival of the Duke and Duchess of Connaught to open the Union Parliament. The main subject dealt with was "The State's Duty to Science," and the South African newspapers all agree that nothing more important or more suitable for the occasion could have been chosen. The State was viewed in succession as an educationist, a landowner, a health guardian, and as a patron of pure science, and under each head illustrations were given from the past actions and present needs of Cape Colony. The chief part of the address is reproduced elsewhere in this issue. The Minister of the Interior, General Smuts, in proposing the usual vote of thanks, threw out some hope that the day of university reform in South Africa was not far distant. At the close of the meeting Dr. Muir presented the South Africa medal to Prof. J. C. Beattie, for his magnetic and other work.

The jubilee of the German Agricultural Society is being commemorated in Berlin this week by a series of meetings. The Berlin correspondent of the *Times* states that at the meeting on December 12 a vast audience in the building of the Prussian Diet listened to the congratulations of the German Emperor, the Imperial Chancellor, the Prussian Minister of Agriculture, and other distinguished personages. In the course of his remarks, the Emperor is reported by the *Times* correspondent to have said:—"Many a seed has been scattered since the society was founded twenty-five years ago, and has sprung up and flourished under the blessings of peace. Admirably have you succeeded in adopting all the advances in science, in botany, in chemistry, in the breeding of animals, and in industry, and so increased the efficiency of German agriculture and raised the value of Germany's soil. Accept my most cordial good wishes for the future. May the agricultural population continue to hold its own as the core of the people, trustworthy in all circumstances, to the advantage and welfare of the Fatherland."

A general meeting of opticians and others was held in the rooms of the Chemical Society, Burlington House, on Tuesday, November 29, to consider the desirability of making arrangements for the holding of an Optical Convention in 1912. The chair was taken by Dr. R. T. Glazebrook, C.R., F.R.S., as chairman of the permanent committee. A resolution was carried *nem. con.* that, provided sufficient financial support is obtained, an optical convention be held in the spring or early summer of 1912. The main objects of such a convention were specified as being:—(1) the holding of an exhibition of optical and allied instruments; (2) the preparation of a catalogue of optical and allied instruments of British manufacture to serve as a convenient work of reference for all users of optical and scientific instruments, not necessarily to be limited to instruments actually exhibited; (3) the holding of meetings for the reading of papers and for discussions and demonstrations on optical subjects; (4) the publication of a volume of Proceedings, in which these papers would be collected together. The questions of the inclusion of a foreign section and of the scope of the convention and exhibition were discussed, and an organising committee was nominated to undertake the work of making the necessary arrangements for the convention.

The Agenda Club, which was formally inaugurated by a banquet last week, proposes to organise effort, knowledge, and influence for the purpose of getting things done which need doing for the benefit of the community. The movement first acquired publicity through "An Open Letter to English Gentlemen" in the *Hibbert Journal*. This letter, and the club itself, appeal frankly to the idealism and the goodwill of the best men; but an equally essential characteristic of the club is to organise the altruism of its members with at least as much efficiency as that of the most successful modern business. The club expressly enunciates its need of guidance by scientific men in determining the agenda to be undertaken and in many details of its work. It is a coordinating society, and not one that overlaps the work of other bodies devoted to special purposes. Among other methods to be employed is that of the most extensive publicity. It should be able to win recognition of the importance of scientific education, to spread scientific ideas, and to extend the application of scientific method and results to the affairs of everyday life. It contemplates the encouragement of research, especially perhaps in social science, and its scheme includes groups of associates, among which are mentioned engineering, literature, medicine, and science. In thus applying tested principles and modern methods to the desire to help, which, if sometimes latent, is almost universal, the club is effecting, at a singularly opportune and critical moment, a new "grouping," which may prove a significant step forward in social evolution. There is no entrance fee and no fixed subscription. Money without other support is neither invited nor desired, but cooperation, with or without subscriptions, is both sought and welcomed. The address of the club is 4 Essex Court, Temple, E.C.

The report of the council of the Scottish Meteorological Society was presented to the general meeting of the society held on December 6. From it we learn that the prize of 20*l.* offered for competition amongst students and graduates of the Scottish universities for the best essay on a meteorological subject has been awarded by the council to Mr. David MacOwan, of Edinburgh University, for an essay on "Observations in Atmospheric Electricity in and near Edinburgh." The council reports with satisfaction that the publication by the Royal Society of Edinburgh of the observations made on Ben Nevis and at Fort William from 1883–1904 has just been completed by the issue of vol. xliv. of the Transactions of that society. This marks the completion of a great enterprise; and it is noted that not only have the observations themselves been printed in detail, but that the four volumes in which they appear contain also numerous papers in which various theoretical and practical aspects of the observations are discussed. It is a matter of further satisfaction that almost simultaneously with the completion of the publication of the Ben Nevis observations the society has, through the generosity of its friends, been entirely relieved from the burden of debt which it had to assume when the observatories were closed in 1904. The following officers were elected at the meeting:—*President,* Prof. A. Crum Brown, F.R.S.; *vice-presidents,* J. Mackay Bernard and Ralph Richardson; *council,* J. Macdonald, Dr. C. G. Knott, Sir David Paulin, G. Thomson, H. M. Cadell, Captain H. G. Lyons, F.R.S., Sir A. Buchan-Hepburn, Bart., G. G. Chisholm, and M. M'Callum Fairgrieve; *hon. secretaries,* R. T. Omond and E. M. Wedderburn; *hon. treasurer,* W. B. Wilson.

Cancer once again formed the subject of the Bradshaw lecture, delivered by Sir Arthur Pearce Gould at the Royal College of Surgeons on December 7 before a large and appreciative audience, which included Prince Alexander of Teck. For three years in succession, 1903, 1904, and 1905, cancer—although the conditions of the endowment mention merely a "lecture on surgery"—was discussed in speculative fashion and in its surgical aspects by one Bradshaw lecturer after another. This was when the modern revival in the investigation of this disease was in its beginnings, and had contributed little that was new or could be properly appraised. Perhaps from the mere fact that all had been said, and said ably, that could be said, perhaps from a feeling that it was unseemly to harp always upon the same subject, cancer has been left alone for four years. It was well to revert to it again, for by doing so Sir Alfred Pearce Gould put himself in the position of being able to assure his hearers that great advances in knowledge have been made, and that the pessimistic views held by those brought most in contact with the disease are giving way before new hopes. The lecturer showed that the four years' respite had sufficed for the results of the comparative and experimental investigation of cancer to make a deep impression upon the leaders of the surgical profession. He had much to say which no previous Bradshaw lecturer ever had an opportunity of knowing, and much that even his immediate predecessors had not had time to assimilate. The lecture, which appeared in full in both the *Lancet* and the *British Medical Journal* of December 10, will repay the perusal of all interested in this complex problem and the efforts that are being made to solve it.

COMMITTEES have nowadays become quite a usual form for the organisation and supervision of scientific research to take, and investigations conducted under their ægis may at times not redound in full measure to the credit of the actual workers. Therefore, in Sir Alfred Gould's Bradshaw lecture on cancer it is gratifying to note this generous tribute paid to the workers who have raised the English school of cancer research to its present pre-eminent position among kindred organisations abroad. The lecturer said :—" This college, in conjunction with our sister in Pall Mall, by the initiation, control, and housing of the Imperial Cancer Fund, has taken a very prominent part in this movement, and it is a matter of great satisfaction that the researches carried out in our laboratory are universally recognised as having been of fundamental importance. We gladly recognise that all the success which has attended, and may hereafter attend, the labours of Dr. Bashford and his distinguished associates is not due to the association with these Royal colleges, nor to the sources from which the fund has been collected, but to the ability, the wide knowledge, the patience, and the honesty that are associated with the laborious industry of the workers." However excellently committees may be constituted for advisory purposes and for control, they can never replace the initiative and enthusiasm of individual workers. It is gratifying to know that this principle is acknowledged in the investigation of a subject of such great public moment as is cancer.

THE death is announced of Captain G. E. Shelley, the youngest son of the late John Shelley, of Avington, in Hampshire, and nephew of the poet. After a short service in the Grenadier Guards, Captain Shelley retired from the Army and devoted himself entirely to ornithology, especially to that of Africa. Captain Shelley's earliest publication was a " Handbook on the Birds of Egypt," a most useful companion to the voyager on the Nile, illustrated by many excellent coloured plates drawn by Keulemans. He next turned his attention to the sun-birds (Nectariniidæ), and in 1880 completed a beautiful quarto work containing coloured figures of every species of this brilliant family, which may be said to represent the humming-birds of the New World in Africa and Asia, although the two groups are by no means nearly related to each other. In 1890 Captain Shelley was requested by Dr. Gunther to join Mr. Sclater in preparing the nineteenth volume of the great " Catalogue of Birds in the British Museum." To this he gladly consented, as among the families included in this volume were the cuckoos and other groups of which he had made a special study. Captain Shelley now planned a general work on the birds of Africa, in which he proposed to comprise an account of all the birds known to occur in the Ethiopian region. The first volume of this important work was published in 1890, and succeeding volumes were issued up to 1906, when the failing health of the author brought the continuance of the work to a stop. Besides these three works, Captain Shelley was for many years a constant contributor to the *Ibis*, the journal of ornithology published by the British Ornithologists' Union, of which he was a well-known member. He was also an excellent field naturalist, and made many excursions to different parts of Africa in order to observe the bird life with his own eyes and to add to his valuable collections, which, we believe, have attained a final resting place in the British Museum.

THE Berlin correspondent of the *Times* reports the death, at seventy-eight years of age, of Prof. Franz Konig, who held in succession the chair of surgery at the Universities of Rostock (1869), Göttingen (1875), and Berlin (1895). He retired from the latter chair in 1904. His reputation was based largely on his skill in the treatment of articular tuberculosis, on which he published a monograph in 1883 (later edition, 1895). He was also author of teaching manuals of surgery, which were frequently republished.

THE *Aeronautical Journal* for October contained the announcement that the council of the Aëronautical Society had conferred the gold medal of the society on Mr. Octave Chanute, consulting engineer, of Chicago. It was regretted that there was no immediate prospect of his being able to receive the medal in person, owing to the serious illness which overtook him at Carlsbad, from which, however, it was confidently expected that he had recovered after removal to Paris. It is with greater regret that we now learn of the death of Mr. Chanute at seventy-eight years of age. Born in Paris in 1832, Chanute trained as an engineer in America, where his professional duties involved the construction of numerous railways and bridges, including consultative duties connected with the New York elevated railway ; wood preservation was also his speciality. From 1874 onwards Chanute became interested in the problem of aviation, and not only did he make numerous experiments with models, but shortly after, or perhaps simultaneously with, Lilienthal and Pilcher's experiments in Europe Chanute took up the practical realisation of gliding flight in America in collaboration with Mr. Herring and Mr. Avery. A large number of glides were made with different types of glider, commencing with a model based on the descriptions of Le Bris's historic " albatross," and including gliders with a large number of superposed planes, but the type finally adopted was a biplane glider furnished with a smallish balancing tail. Although balance was, as a rule, maintained by moving the body, Chanute embodied in his apparatus the principle of a flexible framework, which thus paved the way for the Wright Brothers' " warping " devices and similar arrangements for the recovery of balance and counteraction of instability, which form such a noteworthy feature of modern aëroplanes. The glides made with his machines were remarkably successful, and, the practising grounds being among sand dunes, no fatalities ensued. Chanute was the author of a number of papers and reviews dealing with the flight problem, and the Wright Brothers, the late Captain Ferber, and numerous other aviators were indebted to him for much valuable assistance.

THE annual general meeting of the Royal Agricultural Society of England was held on December 7. It was announced that the total membership is now 10,129, having reached five figures for the first time since 1901. The report, which was adopted at the meeting, contains abundant evidence that the society is assisting scientific research in agriculture in a substantial manner. At the Woburn Experimental Station, in addition to general experiments, trials have been made of the new varieties of cross-bred wheats introduced by Prof. Biffen, of Cambridge, and also of French wheats. The residual values of calcium cyanamide and nitrate of lime have been ascertained in comparison with sodium nitrate and sulphate of ammonia. The pot-culture work has included further experiments on the influence of magnesia on plants. The Hills' experiments concerned chiefly the use of zinc in different forms and of lithium. The question of green-manuring with leguminous and non-leguminous crops respectively has been advanced a further stage. In the botanical department some forty specimens of infected plants were sent for examination. For the most part these were attacked by common diseases, but the following are not so generally met with :—silver-leaf on black currant, Pseudomonas on swede, and Hypomyeces on mushrooms. Two diseases, one on mangolds the other on asparagus, are apparently new to science, and are now under investigation. The society has decided to carry out experiments with calves at the Woburn Farm, for the purpose of demonstrating that by means of isolation it is possible to rear healthy stock from tuberculous parents. Lord Rothschild has undertaken to provide, free of all expense to the society, thirty calves for the purposes of the proposed demonstration. The arrangements are in the hands of a special committee, and Sir John McFadyean has undertaken to supervise the demonstration. With the view of enabling the Royal Veterinary College to make further investigations as to Johne's disease, an obscure disease of sheep met with in certain parts of England, and vaccination as a preventive against tuberculosis in cattle, the council has agreed to make a special grant to the college of 200*l.* per annum for three years, commencing on January 1, 1911.

The trustees of the Beit memorial fellowships for medical research have elected the following persons to fellowships. We give in each case the general character of the proposed research and the place where it is intended to carry out the research :—*T. R. Elliott*, pathological changes in the suprarenal glands, at the Medical School of University College Hospital. *E. E. Aitkin*, investigation of a group of toxins with respect to the manner of destruction, mode of neutralisation by antibody, and effect of the various modifications upon the animal organism, at the Bacteriological Laboratory of the London Hospital. *Frances Mary Tozer*, the presence of sensory fibres in the third, fourth, and sixth cranial nerves; their influence upon ocular paralysis in locomotor ataxia and other diseases, and the site of the ganglion cells, at the Physiological Laboratory, Liverpool University. *R. W. H. Row*, the structure, development, and functions of the pituitary body in Vertebrata, at (1) King's College, London (Zoological Laboratory); (2) Marine Biological Association's Laboratory; and (3) Naples Zoological Station (collection of specimens and embryological and experimental work). *H. Priestley*, study of the diphtheroid organisms with regard to their distribution, morphology, cultural characteristics, pathology, and relationship to diseased conditions of man and animals, at the Lister Institute of Preventive Medicine. *F. P. Wilson*, the changes in the lipoids of the tissues produced by syphilis and their relation to hæmolysis and immunity, at the Biochemical Department, University of Liverpool. *A. G. Yates*, the bacteriology of acute rheumatism, at the Pathological Department of the University of Sheffield. *Annie Homer*, the chemistry and physiology of tryptophane; the metabolism and chemistry of hæmoglobin in so far as they bear on its production in the animal body; the comparison of normal and pathological tissues as regards their contents of intracellular ferments, at the Physiological and Chemical Laboratories, Cambridge. *F. J. F. Barrington*, investigation of the functions of the male accessory genital glands, at University College Medical School. *J. F. Gaskell*, the origin of the suprarenal body in the invertebrates and lower vertebrates, and on the function of the chlorogogen cells in invertebrates, at St. Bartholomew's Hospital Medical School. The next election of fellows will be held in December, 1911. Correspondence should be addressed to the honorary secretary, Beit Memorial Fellowships for Medical Research, 35 Clarges Street, W.

In the *Philippine Journal of Science* (vol. v., No. 3) Mr. R. B. Bean gives a further account of his investigations into the different types of ears occurring among the Philipinos, giving on this occasion illustrations of the Iberian and the primitive types. In the former the characteristic features are the inversion of the conch and the rolling out of the helix, this producing a shallow bowl in the conch and a flat helix below. The whole ear is thin, flattened, and usually placed parallel to the head. The primitive ear, on the contrary, is distinguished by the inversion of the conch and the rolling in of the helix, the upper and lower portions of the latter projecting in the form of a shelf, while the conch is deep and bowl-like. The whole ear is thick. In the opinion of the author, ears afford much better race-characters than skulls.

In the report for the year ending September 20, the committee of the Bristol Museum and Art-gallery expresses its obligation to Lady Smyth for her gift of 1500*l.* to fit up a companion room to the one for which she had previously provided funds. This will enable the adjacent rooms to be arranged in uniformity. Among the additions to the collection is the skin of a giraffe from East Africa, which is now in the hands of the taxidermist, and will in due course be installed in the building.

The new museum and art-gallery opened at Plymouth on October 25 form the subject of an illustrated article in the November number of the *Museums Journal.* The foundation-stone of a building was laid so long ago as the Diamond Jubilee year of Queen Victoria, but soon after this was done the financial affairs of the city became involved in difficulty, and further progress was stopped. Later on Mr. Andrew Carnegie offered a large sum for the building of a public library, and it was eventually decided to combine with the library a museum and art-gallery, for which funds were provided from other sources. The result is the present fine building, constructed partly of Portland stone and partly of Devonian limestone, with a total frontage of about 320 feet. Of this, the northern 180 feet are allotted to the museum and art-gallery. The whole building is one of which Plymouth may justly be proud.

Amongst publications recently issued by the International Council for the Study of the Sea are vol. xii. of the *Rapports et Proces-Verbaux*, vol. iv. of the *Bulletin statistique*, and No. 48 of the *Publications de Circonstance.* The first of these contains useful summaries of the fishery work carried out under the direction of the council. Dr. Hoek gives an account of the recent work on eggs and larvæ of the Gadidæ, Prof. D'Arcy Thompson of that on the distribution of the cod and haddock, Dr. Ehrenbaum on the eggs and larvæ of flat-fishes and Dr. Masterman on their later stages, and Dr. Hjort reports on the herring investigations. The statistical bulletin contains a summary of all fish landed in the different European countries in 1907. The last of the three publications deals with the plankton researches, and gives a list of all organisms which have been recorded between 1905 and 1908 on the periodic cruises, with an account of the stations at which they were found. This forms a useful summary of the detailed tables published in the bulletins.

IN an abstract from the *American Breeders' Magazine* (vol. i., No. 2) Dr. G. H. Shull adduces further evidence in favour of a so-called pure-line method in corn breeding that consists in raising self-fertilised generations with the object of developing pure homozygous strains or biotypes, and then cross-breeding from such pure strains year by year.

A NOTE on works of improvement in the forests of the Federated Malay States, contributed by Mr. A. M. Burn-Murdoch, appears in the *Indian Forester* (October). The author distinguishes gutta-percha forests, where *Palaquium gutta* and *P. oblongifolium* are the important species, and mixed timber forests. Under natural conditions the Palaquium forests contain a great number of tall, slender trees in the pole stage arising from an undergrowth of palms, chiefly *Eugeissona tristis*, and shrubs; there are also a few giant trees. When the young trees are cleared of the undergrowth some are unable to support their own superstructure and require lopping, from which, however, they quickly recover.

A PALM disease receiving the name of "koleroga" is described at length by Dr. L. C. Coleman in Bulletin No. 2, issued by the Department of Agriculture in the Mysore State. The disease, confined to the Areca palm, has been prevalent in two separate areas on the west coast of India. For the most part the fruits are attacked, but occasionally the fungus finds its way to the growing apex. Spraying with Bordeaux mixture has proved efficacious. From a study of the sporangiophores, zoospores, and both kinds of sexual organs, and from infections made with the spores, the author concludes that the fungus is very closely allied to the well-known *Phytophthora omnivora*, from which he separates it as a special variety.

THE prominent item in the September number (vol. v., No. 4) of the botanical section of the *Philippine Journal of Science* is the first part of a description, by Mr. E. D. Merrill and Mr. M. L. Merritt, of the flora of Mt. Pulog, the highest, but until recently little known, peak in the island of Luzon. Four zones of vegetation are distinguishable, of which the most important is an open forest belt in which *Pinus insignis* is the characteristic tree; this gives place at an altitude of 7000 feet to a denser forest of irregular trees covered with mosses and lichens, where epiphytic ferns and orchids are abundant, while the summit is open meadow. In the flora the families Polypodiaceæ, Compositæ, and Gramineæ are best represented. There is a predominance of continental Asiatic as opposed to Malayan types, together with a definite, although small, admixture of Australian elements.

MR. BERNARD SMITH has written on the Upper Keuper sandstones of east Nottinghamshire in the *Geological Magazine* for 1910 (p. 302). His study of the characters of these rocks bears out the view, shared by Mr. Cresswell in the paper above referred to, that they were accumulated in distinctly shallow water. "Large tracts with isolated pools were laid bare from time to time." The sandstones among the marls are the deposits of wet seasons, and show characteristic signs of flood and current action. Mr. Smith suggests that the grey or green beds in the Keuper are due to the check on oxidation caused by organic remains and humic and organic acids swept down from the land-surface.

FROM the report of the chief of the U.S. Weather Bureau for the fiscal year 1908–9 we note that observations of the lower strata of air by kites and captive balloons are made daily except on Sundays; efforts are being made to secure materials for kites that will not absorb moisture. Measurements of the intensity of solar radiation and the polarisation of sky light were made whenever conditions were favourable; both appear to have had a higher value than during the previous year. Isobaric charts based on telegraphic reports from selected stations throughout the northern hemisphere have been prepared daily, and successful forecasts for about a week in advance have been issued at intervals; Prof. Moore remarks that the application of world-wide observations and upper-air researches to the art of weather forecasting, both for short and long periods, is yearly becoming more apparent. Reports of marine observations by wireless telegraphy have been discontinued on the Atlantic, but the work has been taken up, to some extent, on the Pacific coast. In the climatological summaries we note that the total precipitation is determined from amounts recorded daily, from midnight to midnight.

DR. L. BIRKENMAJER, of the Cracow University, the author of an elaborate biography of Copernicus, has been fortunate to find (in the "Riks-Arkivet," Stockholm, and in the library of Upsala University) several entirely unknown autographs of Nicolaus Copernicus. The most interesting is a letter written by the great astronomer, on behalf of the Bishop and the Cathedral Chapter of Ermland, on July 22, 1516, to Sigismond I., King of Poland. This message conveys to the King embittered complaints against the Teutonic Order "the Knights of the Cross," described as "praedones, latrones et homines scelerati" in the text of the document, which is entirely in Copernicus's own handwriting. For other interesting details we must refer to the memoir published by Dr. Birkenmajer, in collaboration with the distinguished Upsala scholar Dr. Isak Collijn, in the *Bulletin International* of the Academy of Sciences of Cracow, June, 1909.

THE paper read by Sir Robert Hadfield and Prof. B. Hopkinson before the Institution of Electrical Engineers on Thursday last marks an important advance in our knowledge of the magnetic properties of iron and its alloys. By working in the intense fields obtained between the poles of a large electromagnet they have succeeded in showing that iron and its alloys with carbon, silicon, aluminium, nickel, or manganese have definite saturation intensities of magnetisation which are reached, in general, in fields of less than 5000 units. For pure iron the saturation intensity is 1675 units, and for iron carbide about two-thirds of this. Each alloy behaves as a mixture of one or more magnetic substances with materials having permeabilities not differing much from unity. In annealed carbon steels the saturation intensities are 6 per cent. less than for pure iron for each per cent. of carbon present. The tests of alloys of iron with nickel and manganese have not led to any simple relation between their magnetic properties and their composition.

SINCE Coulomb stated the laws of friction of solids on each other more than a century ago, little work has been done on the subject except from the technical point of view, which does not attach much importance to the absolute cleanliness of the surfaces in contact. The *Verhandlungen der Deutschen Physikalischen Gesellschaft* for October 30 contains a short account, communicated by Prof. W. Kaufmann to the Versammlung Deutscher Naturforscher, of some careful experiments on the subject made by his pupil Miss C. Jakob. The glass or brass surfaces used were chemically clean, and were used in a glass chamber, which could be evacuated and dried. The observations were made by tilting a large plate of the material with a perfectly smooth surface until a small piece of the same substance, provided with three spherical feet, would slide down the surface. Sliding begins at a very small angle, 1·5° for glass, and the speed has a fixed terminal value for each angle of tilt up to a little more than 5°, when the motion becomes an accelerated one. Up to this point there is a definite relation between the speed and the friction, and this relation must be substituted for the discontinuous law of Coulomb, according to which friction prevents motion until an angle of tilt of the order of 10° or 20° is attained.

An interesting article on critical speeds for torsional and longitudinal vibrations, by Prof. Arthur Morley, of University College, Nottingham, appears in *Engineering* for December 9. The driving effort of a reciprocating engine, or the resistances to be overcome, may be periodically fluctuating in magnitude, and if the period of such a variation should approach to the period of a free torsional vibration, or to an integral multiple of it, torsional oscillations of some considerable magnitude may be set up, with accompanying high stresses in the material of the shaft. Cases of approach to dangerous resonance with longitudinal vibrations are perhaps much less common in machinery. The author gives a complete mathematical analysis in the article, and concludes with an interesting application to the case of a pit cage and contents weighing ten tons, and being raised by an engine running at 100 revolutions per minute. Taking the net section of the rope at 2·5 square inches and E as 13,000 tons per square inch, the depth at which the natural frequency of vibration of the loaded rope is equal to the speed of the engine is 955 feet, neglecting the weight of the rope. Taking a rope weighing 8·4 lb. per foot, and making allowance for its weight, the depth at which resonance will occur works out to about 862 feet.

OUR ASTRONOMICAL COLUMN.

Nova Aræ, 98.1910.—A telegram from Dr. Ristenpart to the *Astronomische Nachrichten* (No. 4457) states that the magnitude of Nova Aræ, recently discovered by Mrs. Fleming, was 9·6 on November 19.

The nova is invisible on forty-four plates of the region taken at Arequipa during the period August, 1889, to March 19, 1910, but appears on twenty-one photographs secured between April 4 and August 3 of this year; on these plates its magnitude apparently ranges from 6·0 to 10·0, and thus it would appear that between March 19 and April 4 the magnitude increased from 12·0, the limiting magnitude of the Arequipa plates, to 6·0. Like most of its class, this nova lies well in the Milky Way, its position (1875·0) being $\alpha = 16\text{h}.\ 31\text{m}.\ 4\text{s}.$, $\delta = -52^\circ\ 10{\cdot}4'$.

Saturn's Rings.—Herr K. Schiller, writing to the *Astronomische Nachrichten* (No. 4458), states that he observed Saturn's ring system on November 26 at Bothkamp, and could detect no extraordinary feature such as was described by M. Jonckheere in an earlier communication; the atmospheric conditions were excellent, and Herr Schiller employed powers of 200, 600, and 800.

Publications of the Allegheny Observatory.—We have received the first four numbers of vol. ii. of the Publications of the Allegheny Observatory of the University of Pittsburgh, and give brief abstracts of them below. In No. 1 Prof. Schlesinger describes the Mellon spectrograph with which he and the other observers prosecute their radial-velocity researches. This instrument was provided, by the generosity of Mr. Andrew Mellon, for line-of-sight work when the Keeler memorial telescope was completed in 1906. The grave disadvantages arising from the location of an astronomical observatory near a large town, where the sky is never clear and ever illuminated by artificial illuminants, had to be considered when the form of instrument was under contemplation. Consequently, the work which is possible had to be materially restricted, because of the necessity of keeping the possible exposures within reasonable limits, and a one-prism spectrograph was designed. The sacrifice was considerable, but peculiar circumstances rendered it necessary. However, it appeared that useful work might be done if the investigations were confined to such stars as have broad, hazy lines, and this decision has been justified by the results already published. Dr. Schlesinger describes and illustrates the details of the instrument, showing how rigidity has been attained with moderate weight. A region of the spectrum from λ 3930 to λ 4750 can be brought into sharp focus, and under exceptionally good conditions a strong spectrum of a fifth-magnitude star can be obtained in about twenty minutes. Owing to the impurity of the town atmosphere, the large mirror of the Cassegrain reflector has to be resilvered once a month, and the small one every other week; even then, at times, they only reflect about half as much light as when newly silvered, and some 40 per cent. of the deterioration takes place within three or four days of resilvering. The arrangements for maintaining the temperature range of the prism box within 0·1° C., for eliminating flexure, and for adjusting the focus are minutely described and very ingenious.

In No. 2 Dr. Schlesinger and Mr. D. Alter discuss the relative motions of 61 Cygni and similar stars. This discussion indicates that the motion of the companion star is orbital rather than in a straight line—that the two stars are physically connected; thus the designation "of the 61 Cygni type," as indicating pairs not physically connected, should be abandoned.

No. 3 contains a discussion of the orbits of the spectroscopic components of ϵ Herculis, by Dr. R. H. Baker, determined from seventy-two plates taken with the Mellon spectrograph during 1907–8. The period is found to be 4·0235 days, and the orbit nearly circular; there is no substantial evidence for the presence of a third body. In No. 4 Dr. Baker discusses the orbit of 1 H. Cassiopeiæ, from fifty-seven plates secured during 1908–9, and finds the period to be 6·067 days.

The Orbit of the Perseids.—Meteoric astronomy is being, and is likely to be, considerably advanced by the energetic and organised observations of the Antwerp Société d'Astronomie. Since 1896 the Perseid and other showers have been independently observed at many stations, and the results collated and discussed. During 1909 and 1910, 485 and 303 Perseid trails were recorded, and indicate the existence of seven radiants. For five of the best marked of these M. Henri Dierckx has calculated elliptic elements, which he compares with Hayn's elements for Tuttle's comet, 1862 III., in an article appearing in Nos. 11–12 of tho *Gazette astronomique*. The agreement is well marked, although, as the author remarks, the probably large area covered by the swarm of meteoritic particles precludes the expectation that the Perseid elements would rigidly agree *inter se*.

Definitive Elements for the Orbit of Comet 1904 II. (1904*d*).—This comet was discovered by M. Giacobini at Nice on November 17, 1904, and was observed until May 2, 1905. Herr J. Sedláček has now discussed 118 observations, referred to eighty-four comparison stars, and publishes the resulting orbital elements in No. 4453 of the *Astronomische Nachrichten*. The orbit appears to be hyperbolic, but the departure from a parabola is so slight as to be practically negligible.

Designations of Newly Discovered Variable Stars.—In No. 4457 of the *Astronomische Nachrichten* the commission of the AG Catalogue of Variable Stars gives the permanent designations to 126 recently discovered variable stars. Many of the objects have been discovered to be variable during the present year, whilst the variability of others was detected during preceding years. In addition to the designations, the commission gives the provisional numbers, the positions for 1900, the range of magnitude, and remarks concerning the discovery, the period, the type, and the spectrum of each object.